UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	35.G2354
First Named Inventor or Application Identifier	YOSHIHIRO HONMA
Express Mail Label No.	

APPLICATION ELEMENTS

See *MPEP chapter 600 concerning utility patent application contents.*

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. [ ] Fee Transmittal Form *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification — *Total Pages* 35
3. [X] Drawing(s) *(35 USC 113)* — *Total Sheets* 6
4. [X] Oath or Declaration — *Total Pages* 1
   a. [ ] Newly executed (original or copy)
   b. [X] Unexecuted for information purposes
   c. [ ] Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 17 completed)* ***[Note Box 5 below]***
      i. [ ] DELETION OF INVENTOR(S) Signed Statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4c is checked)* The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4c, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [ ] Assignment Papers (cover sheet & document(s))
9. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] Small Entity Statement(s) [ ] Statement filed in prior application Status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: _____

17. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*
    [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No. ___/_____

18. CORRESPONDENCE ADDRESS

[X] Customer Number or Bar Code Label — 05514 (Insert Customer No. or Attach bar code label here) — or [ ] Correspondence address below

NAME					
Address					
City		State		Zip Code	
Country		Telephone		Fax	

[+]

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	23-20 =	3	X $ 18.00 =	$54.00
	INDEPENDENT CLAIMS (37 cfr 1.16(b))	3-3 =	0	X $ 78.00 =	$0
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			$260.00 =	$0
				BASIC FEE (37 CFR 1.16(a))	$760.00
			Total of above Calculations =		$814.00
	Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).				
				TOTAL =	$814.00

19. Small entity status

a. [ ] A Small entity statement is enclosed

b. [ ] A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.

c. [ ] Is no longer claimed.

20. [X] A check in the amount of $ 814.00 to cover the filing fee is enclosed.

21. [ ] A check in the amount of $ _____ to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 06-1205:

a. [X] Fees required under 37 CFR 1.16.

b. [ ] Fees required under 37 CFR 1.17.

c. [ ] Fees required under 37 CFR 1.18.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED	
NAME	JACK M. ARNOLD
SIGNATURE	Jack M. Arnold Reg #25823
DATE	March 10, 1999

F501\A631812\jg

TITLE OF THE INVENTION

IMAGE PROCESSING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention generally relates to image processing apparatuses and methods for processing images displayed by image display apparatuses such as television monitors and liquid crystal display panels.

Description of the Related Art

Fig. 1 is a block diagram of a conventional video-signal processing apparatus. A charge coupled device (CCD) sensor 1a converts a captured picture into an electrical signal. An analog-to-digital (A/D) converter 2a converts an analog video signal output from the CCD sensor 1a to a digital video signal.

An image-capturing signal processing circuit 3a generates a luminance signal based on the signal output from the CCD sensor 1a by performing color carrier elimination, aperture correction, gamma processing, etc. The image-capturing signal processing circuit 3a simultaneously generates a chroma signal by performing color interpolation, matrix transformation, gamma processing, gain adjustment,

etc., and outputs video signals such as a luminous signal Y, and two chroma signals U and V. A data writing circuit 4a writes the generated video signals in a volatile random access memory (VRAM) 5a.

The VRAM 5a is, for example, a dynamic random access memory (DRAM) provided with writing and reading ports, and performs addressing for each horizontal line.

A timing generating circuit 6a generates timing signals necessary for other circuits. A data reading circuit 7a reads video data stored in the VRAM 5a (see Fig. 4). Accordingly, the data writing circuit 4a stores data (Y_0, U_0; Y_1, V_0; Y_2, U_2; Y_3, V_2; ...) at sequential memory addresses for each horizontal line in the VRAM 5a, and the data reading circuit 7a reads the data for each horizontal line at address pointers H1, H2, ..., and the data size.

A television (TV)-system signal processing circuit 8a outputs TV digital video signals by performing the signal processing (chroma encoding, band correction, composing, etc.) of the Y, U, and V signals read by the data reading circuit 7a.

Digital-to-analog (D/A) converters 9a and 9b convert the digital video signals into analog video signals. Low-pass filters (LPFs) 10a and 10b block high-frequency noise components generated when D/A conversion is performed. A gain adjustment circuit 11a adjusts video signals from the

LPF 10b to have a signal level adapted for liquid crystal display.

A liquid crystal controller 12a generates driving pulses necessary for liquid crystal display, and converts TV signals from the gain adjustment circuit 11a into signals for liquid crystal display. A liquid crystal display panel 13a displays a visible image based on signals from the liquid crystal controller 12a.

A video amplifier 14a outputs video signals from through the LPF 10a at a TV-signal level and impedance. A television (TV) monitor 15a uses a color television broadcasting system such as the NTSC or PAL system to display images.

The operation of the above-described conventional video-signal processing apparatus is described below.

The picture signal from the CCD sensor 1a is converted into a digital video signal by the A/D converter 2a, and is processed by the signal processing circuit 3a to generate luminance signal Y, and chroma signals U and V. The Y signal is obtained by performing color carrier elimination, aperture correction, gamma conversion, etc. The U signal represents the chroma between blue and the Y signal, and the V signal represents the chroma between red and the Y signal. The U and V signals are obtained by performing color interpolation, matrix transformation, gamma conversion, etc.

The Y, U, and V signals output from the signal processing circuit 3a are stored in the VRAM 5a by the data writing circuit 4a, in the order of Y_0, U_0; Y_1, V_0; Y_2, U_2; Y_3, V_2; ..., from the top left of an image as shown in Fig. 4.

The data stored in the VRAM 5a are read in the writing order by the data reading circuit 7a, and are processed by the TV-system signal processing circuit 8a to generate separate luminance and chroma signals, composite signals, and luminance and chroma signals for the liquid crystal display panel 13a.

The digital video signals output from the TV-system signal processing circuit 8a are converted into analog video signals by the D/A converters 9a and 9b. The analog signals are processed by the LPFs 10a and 10b so that bandwidth reduction is performed. The analog signals for the liquid crystal display panel 13a are processed by the gain adjustment circuit 11a so that level matching is performed, and is output to the liquid crystal controller 12a. At the same time, the analog signals for the TV monitor 15a are processed by the video amplifier 14a so that level matching and output impedance adjustment is performed, and are output to the TV monitor 15a.

Fig. 2 is a block diagram of another conventional video-signal processing apparatus. Blocks identical to those in the first described conventional video-signal

processing apparatus are denoted by the same reference numerals to avoid duplicate descriptions.

A DRAM 21a is used for a purpose similar to that of the VRAM 5a. The DRAM 21a stores image data to be displayed on a screen by superimposing or replacing an image captured by a CCD sensor (not shown).

A captured image reading circuit 22a reads data of images captured by the CCD sensor. A superimposing image reading circuit 23a reads the image data for superimposing stored in the DRAM 21a.

A superimposing circuit 24a performs switching, superimposing, or replacement between the captured image data output from the captured image reading circuit 22a, and the superimposing image data output from the superimposing image reading circuit 23a. Outputs from the superimposing circuit 24a are input to a TV-system signal processing circuit 8a.

A description of a process from the TV-system signal processing circuit 8a to a TV monitor 15a is omitted since the process is identical to that in the first described video-signal processing apparatus.

In the above-described conventional video-signal processing apparatuses, images output to the liquid crystal display 13a and the TV monitor 15a are identical. Accordingly, in the case where image capture is performed

with a camera (to which the video-signal processing apparatus is applied) or the like vertically held, a subject in a picture displayed on the TV monitor 15a is horizontal (see Fig. 6D).

Accordingly, in the conventional video-signal processing apparatuses, picture rotation is performed so that picture dimensions match the dimensions of the TV monitor 15a; in other words, when a picture is rotated 90 degrees, its size must be reduced to 3/4 because the aspect ratio of the picture is 3:4.

This causes a problem when the picture is rotated and reduced in size on the liquid crystal display panel 13a, which has a smaller display area than that of the TV monitor 15a, and the subject cannot be clearly seen.

In addition, in the case where character data such as instructions for image capture are displayed on the liquid crystal display panel 13a, if characters displayed on the TV monitor 15a, and characters displayed on the liquid crystal display panel 13a have the same orientation, a problem of questionable operability occurs when the camera is vertically held because the characters on the liquid crystal display panel 13a are horizontally inclined and cannot be easily read.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a video-signal processing apparatus and method for solving the foregoing problems.

It is another object of the present invention to provide an image processing apparatus for enhancing the qualities of images simultaneously displayed on a television monitor and on a liquid crystal display panel.

It is a further object of the present invention to provide an image processing method for enhancing the qualities of images simultaneously displayed on a television monitor and on a liquid crystal display panel.

To these ends, according to an aspect of the present invention, the foregoing objects have been achieved through provision of an image processing apparatus for forming a composite image of at least two images, the image processing apparatus comprising: a storage unit for storing first image data and second image data; a display unit for reading the first and second image data stored in the storage unit, and displaying the read first and second image data in modes adapted for the display forms of the first and second image data; and an image-signal forming unit for forming image signals representing a composite image based on the first and second image data read from the storage unit.

According to another aspect of the present invention, the foregoing objects have been achieved through provision

of an image processing method for forming a composite image of at least two images, the image processing method comprising: a storage step for storing both first image data and second image data; a display step for reading the first and second image data stored in the storage step, and displaying the read first and second image data in modes adapted for the display forms of the first and second image data; and an image-signal forming step for forming image signals representing a composite image based on the first and second image data read from the storage unit.

According to a further aspect of the present invention, the foregoing objects have been achieved through provision of an image processing apparatus for forming a composite image of at least two images, the image processing apparatus comprising: an image capture unit for performing image capture, and generating image signals corresponding to the captured image of a subject; a storage unit for storing first image data generated by the image capture unit, and second image data different from the first image data; a display unit for reading the first and second image data stored in the storage unit, and displaying the read first and second image data in modes adapted for the display forms of the first and second image data; an image-signal forming unit for reading the stored first and second image data, and forming video signals representing a composite image of a

first image represented by the first image data and a second image represented by the second image data so that the first and second images are displayed on the same display screen; and an output unit for externally outputting the video signals formed by the image-signal forming unit.

Further objects, features and advantages of the present invention will become apparent from the following description of the preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing a conventional video-signal processing apparatus.

Fig. 2 is a block diagram showing another conventional video-signal processing apparatus.

Fig. 3 is a block diagram showing a video-signal processing apparatus according to an embodiment of the present invention.

Fig. 4 is a drawing showing the arrangement of data stored in the DRAM 31 shown in Fig. 3.

Figs. 5A to 5D are drawings showing four techniques for reading data from the DRAM 31 shown in Fig. 3.

Figs. 6A to 6D are views showing captured images and character data displayed on display screens.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A video-signal processing apparatus and method according to an embodiment of the present invention is described below.

Fig. 3 is a block diagram of the video-signal processing apparatus. The video-signal processing apparatus can be applied to image capturing devices such as digital cameras. A CCD sensor 1 converts a captured picture into an electrical signal. An A/D converter 2 converts an analog video signal output from the CCD sensor 1 to a digital video signal.

An image-capturing signal processing circuit 3 generates a luminance signal based on the signal output from the CCD sensor 1 by performing color carrier elimination, aperture correction, gamma processing, etc. The image-capturing signal processing circuit 3 simultaneously generates a chroma signal by performing color interpolation, matrix transformation, gamma processing, gain adjustment, etc., and outputs video signals such as luminous signal Y, and two chroma signals U and V.

A data writing circuit 4 writes the Y, U, and V signals output from the image-capturing signal processing circuit 3, in a DRAM 31. A timing generating circuit 6 generates timing signals necessary for other circuits.

The DRAM 31 has writing and reading ports, and is, for example, a video memory that performs addressing for each horizontal line. In the DRAM 31, data of images captured by the CCD sensor 1, and data of superimposing images are stored.

Captured image reading circuits 22A and 22B read the data on images captured by the CCD sensor 1 from the DRAM 31. Superimposing image reading circuits 23A and 23B read the superimposing image data stored in the DRAM 31.

Superimposing circuits 24A and 24B perform switching, superimposing, or replacement between the captured image data from the captured image reading circuits 22A and 22B, and the superimposing image data from the superimposing image reading circuits 23A and 23B.

A TV-system signal processing circuit 8A and a liquid-crystal signal processing circuit 8B respectively output TV-monitor signals and liquid-crystal display signals by performing signal processes (such as chroma encoding, bandwidth reduction, and composing) for output signals from the superimposing circuits 24A and 24B.

D/A converters 9A and 9B convert respective digital video signals (such as composite, separate, and component signals) output from the TV-system signal processing circuit 8A and the liquid-crystal signal processing circuit 8B, to analog video signals.

LPFs 10A and 10B block high-frequency noise components existing when D/A conversion is performed. Gain adjustment circuits 11A and 11B adjust signals from the LPFs 10A and 10B to have a signal level adapted for outputting to the TV monitor 15 and the liquid crystal display panel 13. A liquid crystal controller 12 generates driving pulses necessary for liquid crystal display, and converts output signals from the gain adjustment circuit 11B to signals for displaying images on the liquid crystal display panel 13.

The liquid crystal display panel 13 is provided on a camera to which the present invention is applied, and uses a liquid crystal device to display a visible image based on output signals from the liquid crystal controller 12. A video amplifier 14 outputs signals adapted for a TV-monitor level and output impedance, to the TV monitor 15. The TV monitor 15 is provided separately from the camera, and uses a color television broadcasting system such as the NTSC or PAL system to display images.

The operation of the above-described video-signal processing apparatus is described below.

The picture signal from the CCD sensor 1 is converted to a digital video signal by the A/D converter 2, and is processed by the signal processing circuit 3 to generate luminance signal Y and chroma signals U and V. The Y signal is obtained by performing color carrier elimination,

aperture correction, gamma conversion, etc. The U signal represents the chroma between blue and the Y signal, and the V signal represents the chroma between red and the Y signal. The U and V signals are obtained by performing color interpolation, matrix transformation, gamma conversion, etc. The Y, U, and V signals output from the image-capturing signal processing circuit 3 are stored in the DRAM 31 by the data writing circuit 4, in the order of Y_0, U_0; Y_1, V_0; Y_2, U_2; Y_3, V_2; ..., from the top left of the screen as shown in Fig. 4, which also shows the arrangement of data stored in the DRAM 31.

The superimposing circuit 24A and 24B output signals to the TV-system signal processing circuit 8A and the liquid-crystal signal processing circuit 8B by performing switching, superimposing, and replacement between each captured image data read from the DRAM 31 by the captured image reading circuit 22A and 22B, and each superimposing image data read from the DRAM 31 by the superimposing image reading circuit 23A and 23B.

The TV-system signal processing circuit 8A processes output signals from the superimposing circuit 24A to generate separate luminance and chroma signals, and composite signals. The liquid-crystal signal processing circuit 8B processes output signals from the superimposing circuit 24B to generate luminance and chroma signals. The

digital video signals output from the TV-system signal processing circuit 8A and the liquid-crystal signal processing circuit 8B are converted into analog video signals by the D/A converters 9A and 9B. The analog video signals are processed by the LPFs 10A and 10B so that bandwidth reduction is performed. The analog video signals for the liquid crystal display panel 13 are processed by the gain adjustment circuit 11A, so that level matching is performed, and is output to the liquid crystal controller 12. At the same time, the analog video signals for television display are processed by the gain adjustment circuit 11A and the video amplifier 14A, so that level matching and output impedance adjustment is performed, and are output to the TV monitor 15.

Compared with conventional video-signal processing apparatuses, the video-signal processing apparatus according to this embodiment has the following two features:

One feature is that each function is separated to form a system for TV-monitor display and another for liquid crystal display. In each system, separate signal processing is performed.

Another feature is that techniques for reading data from the DRAM 31 can be selected. Figs. 5A to 5D show four techniques for reading data from the DRAM 31. One technique can be selected from among the technique (shown in Fig. 5A)

for sequentially reading data from the top left to the right of the image line by line, the technique (shown in Fig. 5B) for sequentially reading data from the bottom left to the top of the image, the technique (shown in Fig. 5C) for sequentially reading data from the top right to the bottom of the image, and the technique (shown in Fig. 5D) for reading data from the bottom right to the left of the image. Specifically, image data in the DRAM 31 may be read at arbitrary positions, and when image data are written in the DRAM 31, the image data may be written beforehand at positions obtained when the image data are rotated.

Fig. 5A shows normal image capture with the camera horizontally held. Fig. 5B shows image capture with the camera inclined 90 degrees to the right. Fig. 5C shows image capture with the camera inclined 90 degrees to the left. Fig. 5D shows image capture with the camera inverted for self-image capturing.

The reading of image data obtained by performing image capture in various directions with an image capturing device such as a digital camera is described.

In the case where images are captured at various camera positions, and the images are displayed on the liquid crystal display panel 13 provided on the camera, as shown in Fig. 5A, the sequential reading of image data is always performed from the top left to the right of the image line

by line. This is because the subject is always displayed in its original orientation since the liquid crystal display panel 13 is inclined in the same direction as the CCD sensor 1.

In contrast, since the TV monitor 15 cannot be rotated, together with the camera, if the reading of image data is similarly performed, the subject image is horizontal as shown in Figs. 5B and 5C, and is inverted as shown in Fig. 5D. Accordingly, the image must be rotated so that the subject is displayed in its original orientation by changing the technique for reading image data from the DRAM 31.

In the case where image capture is performed with the camera inclined 90 degrees to the right, by performing the sequential reading of image data from the bottom left to the top of the image, as shown in Fig. 5B, the subject is displayed in its original orientation on the TV monitor 15. Similarly, in the case where image capture is performed with the camera inclined 90 degrees to the left, by performing the sequential reading of image data from the top right to the bottom of the image, as shown in Fig. 5C, the subject is displayed in its original orientation on the TV monitor 15. In the case where image capture is performed with the camera inverted for self-image capturing, by performing the sequential reading of image data from the bottom right to the left, as shown in Fig. 5D, the subject is displayed in

its original orientation on the TV monitor 15.

In addition, when an image is displayed on the TV monitor 15, the superimposing image reading circuit 23A only needs to always read the image line by line from the top left to the right of the image. Conversely, the liquid crystal display panel 13 may need to display an image in accordance with the image capture position.

Figs. 6A to 6D show captured images and character data. Fig. 6A shows a captured image and character data displayed on the TV monitor 15 and the liquid crystal display panel 13 when image capture is performed with the camera held at the normal position. Fig. 6B shows a captured image and character data displayed on the liquid crystal display panel 13 when image capture is performed with the camera 90 degrees inclined. Fig. 6C shows an image and superimposing image data (character data) rotated to matching the image capture direction in Fig. 6B. Fig. 6D shows an image and character data displayed on the TV monitor 15 when image capture is performed with the camera inclined 90 degrees to the right.

In the case where the superimposing image data is always displayed on the liquid crystal display panel 13 in a specific direction, irrespective of the direction of the CCD sensor 1, and image capture is performed with the camera vertically held, the displayed superimposing image data is

90 degrees inclined as shown in Fig. 6B.

Accordingly, by displaying the superimposing image data when image capture is performed with the camera vertically held as shown in Fig. 6C, the characters "DATA CHANGE? YES, NO" can clearly be seen, which increases operability. In this case, a technique for reading data from the DRAM 31 may be selected, similarly to the case of the captured image reading circuit 22A, from among the four techniques of: (1) sequentially reading data line by line from top left to the right of the image; (2) sequentially reading data from the bottom left to the top of the image; (3) sequentially reading data from the top right to the bottom of the image; and (4) sequentially reading data from the bottom right to the left of the image.

By detecting with a gravity sensor the camera position condition, and setting the camera position condition in accordance with an image capture situation, optimal display forms for the TV monitor 15 and the liquid crystal display panel 13 can be selected, so that corresponding data reading is performed. In the optimal display forms, a captured image and superimposing data can be viewed in their original orientation on the TV monitor 15 and the liquid crystal display panel 13.

As described above, by providing a memory (e.g., the DRAM 31 in this embodiment) for temporarily storing captured

image data and superimposing image data, circuits (e.g., the captured image reading circuits 22A and 22B, and the superimposing image reading circuits 23A and 23B in this embodiment) for separately reading captured image data and superimposing image data from the memory, and separate output circuits for displaying images on the liquid crystal display panel 13 and the TV monitor 15; and changing a technique for reading data from the memory in accordance with a camera position condition such as image capture with a camera vertically positioned; the captured image and the superimposing image can be displayed in their original orientations without making a strange impression on viewers.

In the foregoing embodiment, image output apparatuses are a TV monitor 15 and a liquid crystal display panel 13. However, the image output apparatuses may be CRT displays, which are often used as TV monitors; plasma displays; and electroluminescence displays.

In the foregoing embodiment, image capture is performed with the camera inclined in units of 90 degrees. However, the present invention can be applied to the case where image capture is performed with the camera in units of 45 degrees.

According to the present invention, the qualities of images simultaneously displayed on display means such as the TV monitor 15 and the liquid crystal display panel 13 can be enhanced. By way of example, when image capture is

performed with the camera vertically held, the captured image is displayed in its original orientation on the TV monitor 15 without being sideways, and the capture image is clearly displayed on the liquid crystal display panel 13 since the captured image is not rotated and the size of a subject is not reduced. Accordingly, the image is not reduced in size and rotated, whereby it is avoided that the image cannot be clearly viewed.

According to the present invention, in the case where character data such as an instruction concerning image capture is displayed on the liquid crystal display panel 13, when the camera is vertically held, the characters are displayed without being rotated so as to match the orientation of the TV monitor 15, and the characters are rotated and displayed on the liquid crystal display panel 13 so that the characters can be displayed so as to match the orientation of the liquid crystal display panel 13 inclined similarly to the camera. Therefore, images displayed on the TV monitor 15 and on the liquid crystal display panel 13 are clearly read, which improves operability.

According to the present invention, captured images are displayed on a plurality of display means (such as the TV monitor 15 and the liquid crystal display panel 13) in display forms adapted for the display means.

According to the present invention, by selecting a

technique for reading stored image data from among the four techniques of: (1) sequentially reading data line by line from top left to the right of the image; (2) sequentially reading data from the bottom left to the top of the image; (3) sequentially reading data from the top right to the bottom of the image; and (4) sequentially reading data from the bottom right to the left of the image, a captured image can be displayed in its original orientation.

According to the present invention, when a superimposing image is displayed, together with an image captured at an inclined image-capture position, the images can be displayed in their original orientations on the same screen.

According to the present invention, when image capture is performed at an image-capture position inclined 90 degrees to the right, a subject in the captured image is displayed in its original orientation on the TV monitor 15 by sequentially reading stored image data from the bottom left to the top of the image. When image capture is performed at an image-capture position inclined 90 degrees to the left, the subject is displayed in its original orientation on the TV monitor 15 by sequentially reading stored image data from the top right to the bottom of the image. When image capture is performed at an inverted image-capture position, the subject is displayed in its

original orientation on the TV monitor 15 by sequentially reading stored image data from the bottom right to the left.

WHAT IS CLAIMED IS:

1. An image processing apparatus for forming a composite image of at least two images, said image processing apparatus comprising:

storage means for storing first image data and second image data;

display means for reading the first and second image data stored in said storage means, and displaying the read first and second image data in modes adapted for display forms of the first and second image data; and

image-signal forming means for forming image signals representing a composite image based on the first and second image data read from said storage means.

2. An image processing apparatus according to Claim 1, wherein the stored first or second image data are respectively read at arbitrary positions in an arbitrary order.

3. An image processing apparatus according to Claim 2, wherein said display means changes an order of reading the first or second image data stored in said storage means in accordance with whether a display screen for displaying the first and second image data is vertically or horizontally

positioned.

4. An image processing apparatus according to Claim 2, wherein said display means reads one of the first and second image data in order different from an order of reading the other one of the first and second image data in accordance with whether a display screen for displaying the first and second image data is vertically or horizontally positioned.

5. An image processing apparatus according to Claim 2, further comprising image capture means for capturing the image of a subject, and supplying image signals corresponding to the captured image to said storage means, wherein while image capture is being performed at a vertical image-capture position, when a first image represented by video signals output from said image capture means, and a second image different from the first image are displayed, the second image data are read in an order different from the order of reading said first image data stored in said storage means, and wherein while image capture is being performed at a horizontal image-capture position, when the first image represented by video signals output from said image capture means, and the second image different from the first image are displayed, the second image data are read in an order identical to the order of reading the first image

data stored in said storage means.

6. An image processing method of forming a composite image of at least two images, said image processing method comprising:

a storage step of storing first image data and second image data;

a display step of reading the first and second image data stored in said storage step, and displaying the read first and second image data in modes adapted for display forms of the first and second image data; and

an image-signal forming step of forming image signals representing a composite image based on the first and second image data read from said storage means.

7. An image processing method according to Claim 6, wherein said storage step reads the stored first or second image data at arbitrary positions in an arbitrary order.

8. An image processing method according to Claim 7, wherein said display step changes the order of reading the first and second image data stored in said storage means in accordance with whether a display screen for displaying the first and second image data is vertically or horizontally positioned.

9. An image processing method according to Claim 7, wherein said display step reads one of the first and second image data in an order different from an order of reading the other one of the first and second image data in accordance with whether a display screen for displaying the first and second image data is vertically or horizontally positioned.

10. An image processing method according to Claim 7, further comprising an image capture step of capturing an image of a subject, and supplying image signals corresponding to the captured image to said storage step, wherein while image capture is being performed at a vertical image-capture position, when a first image represented by video signals output from said image capture step, and a second image different from the first image are displayed, the second image data are read in an order different from the order of reading said first image data stored in said storage step, and wherein while image capture is being performed at a horizontal image-capture position, when the first image represented by video signals output from said image capture step, and the second image different from the first image are displayed, the second image data are read in an order identical to the order of reading the first image

data stored in said storage step.

11. An image processing apparatus for forming a composite image of at least two images, said image processing apparatus comprising:

image capture means for performing image capture, and generating image data corresponding to a captured image of a subject;

storage means for storing first image data generated by said image capture means, and second image data different from said first image data;

display means for reading the first and second image data stored in said storage means, and displaying the read first and second image data on a display screen in modes adapted for display forms of the first and second image data;

image-signal forming means for reading the stored first and second image data, and forming video signals representing a composite image of a first image represented by the first image data and a second image represented by the second image data so that the first and second images are displayed on a same display screen; and

output means for externally outputting the video signals formed by said image-signal forming means.

12. An image processing apparatus according to Claim 11, wherein while image capture is being performed at a first image-capture position, when the first and second images are displayed, said display means reads the second image data in an order different from an order of reading the first image data stored in said storage means, and wherein while image capture is being performed at a second image-capture position, when the first and second images are displayed, said display means reads the second image data in an order identical to the order of reading the first image data stored in said storage means.

13. An image processing apparatus according to Claim 11, wherein irrespective of the position of image capture, said display means reads the first image data in an order identical to the order of writing the first image data.

14. An image processing apparatus according to Claim 11, wherein while image capture is being performed at a first image-capture position, said display means reads one of the first and second image data stored in said storage means in an order different from the order of reading the other one of the first and second image data, and wherein while image capture is being performed at a second image-capture position, said display means reads one of the first

and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data.

15. An image processing apparatus according to Claim 11, wherein when the display screen is in the first condition thereof, said display means reads the second image data stored in said storage means in an order different from the order of reading the first image data, and wherein when the display screen is in the second condition thereof, said display means reads the second image data stored in said storage means in an order identical to the order of reading the first image data.

16. An image processing apparatus according to Claim 11, wherein when the display screen is in the first condition thereof, said display means reads the first image data stored in said storage means in an order different from an order of writing said first image data, and wherein when the display screen is in the second condition thereof, said display means reads the first image data stored in said storage means in an order identical to the order of writing the first image data.

17. An image processing apparatus according to Claim

11, wherein when the display screen is in the first condition thereof, said display means reads one of the first and second image data stored in said storage means in an order different from an order of reading the other one of the first and second image data, and wherein when the display screen is in the second condition thereof, said display means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data.

18. An image processing apparatus according to Claim 11, wherein while image capture is being performed at a first image-capture position, said display means reads the second image data stored in said storage means in an order different from the order of reading the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of reading said second image data, and

wherein while image capture is being performed at a second image-capture position, said display means reads the second image data stored in said storage means in an order identical to the order of reading the first image data, and even said image-signal forming means reads the first image data stored in said storage means in an order identical to

the order of reading the second image data.

19. An image processing apparatus according to Claim 11, wherein while image capture is being performed at a first image-capture position, said display means reads the first image data stored in said storage means in order different from an order of writing the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of writing the first image data, and

wherein while image capture is being performed at a second image-capture position, said display means reads the first image data stored in said storage means in an order identical to the order of writing the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of writing the first image data.

20. An image processing apparatus according to Claim 11, wherein while image capture is being performed at a first image-capture position, said display means reads one of the first and second image data stored in said storage means in an order different from an order of reading the other one of the first and second image data, and said image-signal forming means reads one of the first and second

image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data, and

wherein while image capture is being performed at a second image-capture position, said display means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data, and said image-signal forming means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data.

21. An image processing apparatus according to Claim 11, wherein when the display screen is in the first condition thereof, said display means reads the second image data stored in said storage means in an order different from the order of reading the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of reading said second image data, and

wherein when the display screen is in the second condition thereof, said display means reads the second image data stored in said storage means in an order identical to the order of reading said first image data, and said image-

signal forming means reads the first image data stored in said storage means in an order identical to the order of reading said second image data.

22. An image processing apparatus according to Claim 11, wherein when the display screen is in the first condition thereof, said display means reads the first image data stored in said storage means in an order different from an order of writing the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of writing the first image data, and

wherein when the display screen is in the second condition thereof, said display means reads the first image data stored in the storage means in an order identical to the order of writing the first image data, and said image-signal forming means reads the first image data stored in said storage means in an order identical to the order of writing the first image data.

23. An image processing apparatus according to Claim 11, wherein when the display screen is in the first condition thereof, said display means reads one of the first and second image data stored in said storage means in an order different from an order of reading the other one of

the first and second image data, and said image-signal forming means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data, and

wherein when the display screen is in the second condition thereof, said display means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data, and said image-signal forming means reads one of the first and second image data stored in said storage means in an order identical to an order of reading the other one of the first and second image data.

ABSTRACT OF THE DISCLOSURE

An image processor which forms a composite image of at least two images includes a storage unit which stores first and second image data, and a display unit which reads and displays the stored first and second image data in modes adapted to display forms of the first and second image data. The image processor also includes an image-signal forming unit which forms image signals representing a composite image of the stored first and second image data for display on a television monitor and a liquid crystal display panel.

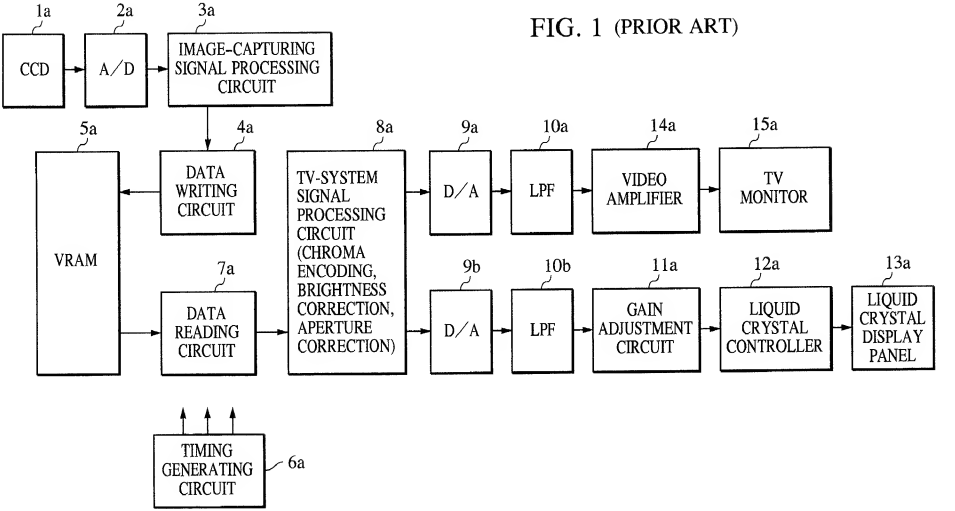


FIG. 1 (PRIOR ART)

FIG. 2 (PRIOR ART)

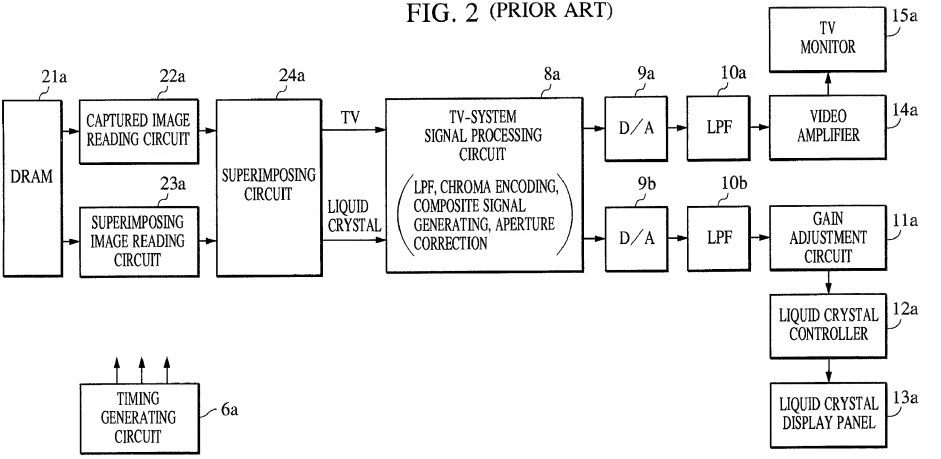


FIG. 3

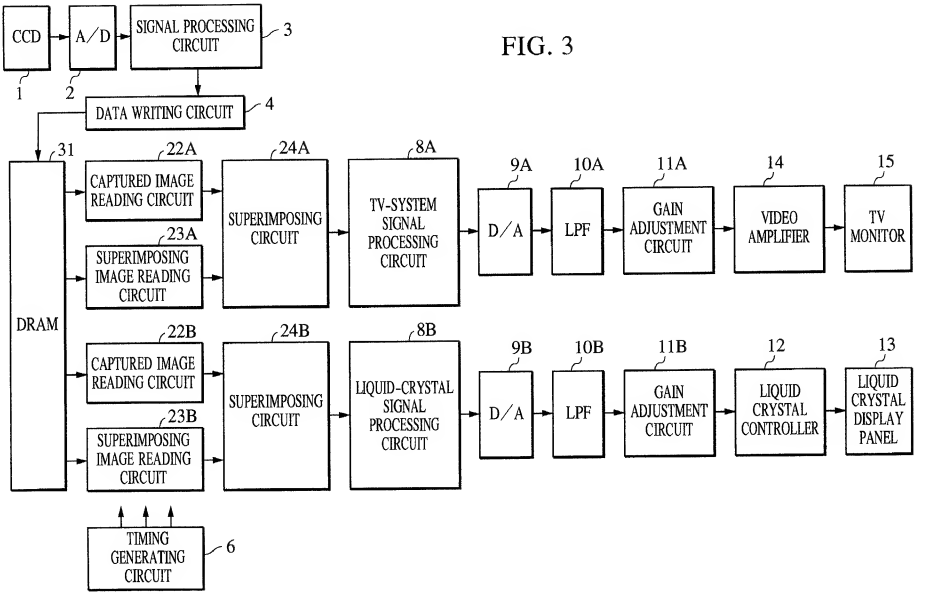


FIG. 4

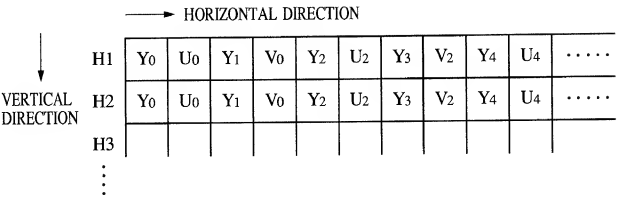


FIG. 5A

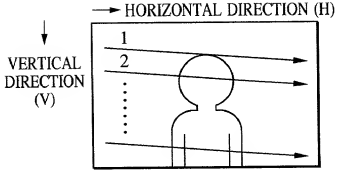


FIG. 5B

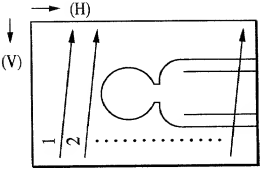


FIG. 5C

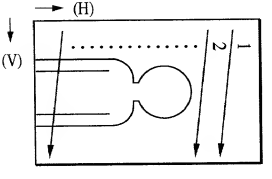


FIG. 5D

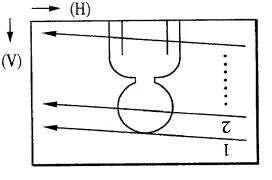


FIG. 6A

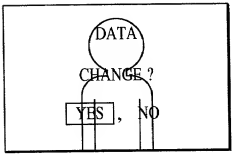


FIG. 6B

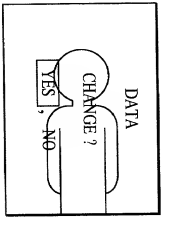


FIG. 6C

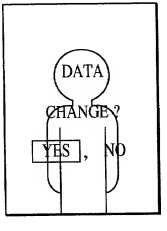
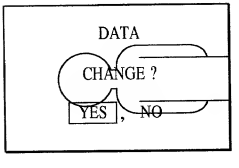


FIG. 6D



COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled IMAGE PROCESSING APPARATUS AND METHOD, the specification of which [X] is attached hereto [ ] was filed on _____ as United States Application No. or PCT International Application No. _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b), of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

Country	Application No.	Filed (Day/Mo./Yr.)	(Yes/No) Priority Claimed
Japan	076449/1998	11 March 1998	Yes

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Application No.	Filed (Day/Mo./Yr.)	Status (Patented, Pending, Abandoned)
NONE		

I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

FITZPATRICK, CELLA, HARPER & SCINTO
Customer Number: 05514

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of First Inventor YOSHIHIRO HONMA

Inventor's signature _____

Date _____ Citizen/Subject of Japan

Residence 335-6, Kamiuchimagi, Oaza, Asaka-shi, Saitama-ken, Japan

Post Office Address c/o CANON KABUSHIKI KAISHA, 3-30-2, Shimomaruko, Ohta-ku, Tokyo, Japan